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ABSTRACT

In a study of spatial orientation, 40 boys and 40 girls from kindergarten and first grade placed a series of objects in front, behind, and beside themselves, and in front, behind, and beside other objects. Some objects had distinguishable front and back sides; others lacked such features. Placements were highly consistent within and across children in respect to location of object vis-a-vis the child's own body or the other object. Systematic variations occurred in children's placement of the face of featured objects in reference to self. These variations appeared related to testing order and type of object placed. Results showed that the children agreed as to what defined fronts and backs of objects. In general, results suggest that the concept of front-back is more complex and subtle than previously believed. (Author)

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The Role of Front-Back Features in Children's 'Front', 'Back', and 'Beside' Placements of Objects

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Of the various facets of spatial orientation, research and common observation show that young children master the concept of front-back relatively early in life - far earlier, certainly, than they learn left-right. In this research, however, children's knowledge of front-back has been tested simply by asking them to point to or otherwise identify the front and back of objects having distinguishable front-back features. The object most commonly used is the child's own or another's body. Young children pass this sort of test quite easily. In a separate study (Harris & Strommen, 1971), children between the ages of five and ten were asked, "Where is your front?" and "Where is your back?". Nearly all the children immediately pointed to their abdomens or chests and then to their backs. When they were asked, "How can you tell your front from your back?", about 90% mentioned either being able to see the front and not the back, the presence of the eyes or the face on the front, or the distinct physical characteristics of the abdomen or chest and back, e.g., " 'Cause the front's 'jiggley' and the back's hard". Originally, then, the basis for children's acquisition of the front-back distinction seems to rest on the fact that there are distinct physical and functional differences between the front and back of their own bodies.

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But has the child really mastered the concept simply because he demonstrates that he knows his own or another's front and back? This demonstration by no means exhausts the possibilities for the concept. We also could ask, what does he understand, "in front of", or "in back of" to mean with respect to a relation between two bodies? Does "in front of" mean "face to face", or "face to back", or something else? And what of objects which have front-back features but, unlike animal forms, lack eyes or faces? Does the child's understanding of front-back for, say, chairs and vehicles parallel his understanding for animal forms? Finally, what of featureless objects, which, by the criterion of eyes and faces, cannot have fronts and backs? How are children able to follow the instructions to "put the drinking glass in front of the box", or "beside the plate", or "behind the bowl"? On what bases, in addition to or instead of eyes or other features, are front and back distinguished?

We hoped to be able to infer these other bases, and to learn something of the further course of development of the concept, by systematic observation of how children place various featured and non-featured objects in reference to their own bodies and to other featured and non-featured objects.

In a sense the question we are pursuing is as much linguistic as perceptual-cognitive. That is to say, we are asking what precisely the concept of front-back means as evidenced in the child's behavior. Thus, the explication of the term "in front of" amounts to identifying how responses to the instruction, "put this in front of that", vary under different circumstances.

Method

Subjects. The subjects were 40 girls and 40 boys, ranging in age from 4:9:0 to 7:5:16. All the children were enrolled in kindergarten or first grade in two public schools in East Lansing, Michigan, at the time of testing. Both schools are located on the Michigan State University campus, and the great majority of children are from student and faculty families. All the children who participated would be characterized as middle-class as indicated by parents' educational level. The IQ range from which this sample was chosen averages somewhat above normal. Approximately half the children, representing the full age range, were tested in a special summer art program, while the remaining children were tested the following winter. Results showed no effect of time of testing.

Stimulus materials. Each child made a series of 'in front', 'in back', and 'beside' placements of common objects. There were seven pairs of objects in all, of which three pairs lacked front-back features, and four pairs had such features.

The featureless category consisted of a pair of symmetrical, uniformly colored plastic drinking glasses - one yellow, one green; a pair of symmetrical wood blocks - one red, one green; and a third pair which consisted of a blue glass and yellow block.

The featured category consisted of a pair of 3-in.-high dolls - a boy and girl; a pair of toy bugs - one green, one yellow - approximately 2 in. in diameter; a pair of toy vehicles - red car and brown truck; and a pair of doll-house chairs - differing in style, one brown, one blue. We chose these featured objects so as to include objects which repre-

sented living things both human and non-human by reason of their having eyes (dolls & bugs), representations of objects which had the capacity for self-propelled movement but were not alive and lacked faces (vehicles), and representations of non-living inert objects which lacked faces (chairs).

Procedure. Each child was tested individually in a spare room in the school. The child sat on the floor, and objects were placed on a three-ft. square white poster board positioned in front of the child. The experimenter sat slightly behind and to the child's left throughout the session.

At the outset of testing, E showed the child a bag filled with 10¢ prizes and told him to pick a prize for taking part in the task. The prize was then set aside until the task was completed.[3]

Each child made two kinds of placements: "object-referent" and "self-referent" with the objects from both categories.

1. For the object-referent condition E placed one member of a pair of objects in front of S and, for placement, one [redacted] told S to place the other member in front of the first member, for another placement [redacted] behind the first member, and for still another, [redacted] beside the first member. (We shall call the object placed by the child the "placed object", and the other object the "referent object".) The actual instructions, recited from memory, were as follows: "I want to see whether you know where to put things. See this ____? [E showed S a member of one of the pairs] I'm going to put it on the board, right here [E placed the object in the direct center of the board.] Now, I'm going to give you something to put on the board. You can put it anywhere on the board that you like.

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You can put it here [indicating the side closest to the child], or here, or here [etc., indicating, with sweeping movements of his hand, all areas of the board]. OK, here's a _____ [the other member of the pair]; put it in front (behind, beside) the _____." [Out of S's line of vision, E recorded S's placement onto a response sheet so as to represent both location and orientation of his placement. In the object-referent condition, the referent object was always set a constant distance from the child.

2. For the self-referent condition, E gave S one member of a pair and, for one placement, told him to place it in front of himself, for another behind himself, and for still another beside himself (making three placements on each of seven trials for the seven pairs of objects for a total of 21 placements). The actual instructions differed from those in the object-referent condition only as required by the change in the condition. Two additional poster boards were used, one behind S, another on his right side.

For the three pairs of featureless objects, there was one trial of three placements for each pair. For the four pairs of featured objects, there were three trials of three placements each for each pair. On all these trials, the referent object was in front of S. The trials differed from one another in how the face of the referent object was turned in relation to S. On one trial, the face of the referent object was turned toward the child, on another it was turned 180° away from the child, and on a third it was turned 90° right or left.

In both conditions, after every placement, E removed the placed object without commenting on S's placement.

We had to be able to conclude that any systematic patterns of placement were not merely a consequence of the method of presenting the objects. For example, it seemed possible to us that a child might place an object in the same orientation as it was given him. On this possibility, on at least half the trials for each S, E routinely presented the object in such an orientation as to require S to re-orient the object before placing it. No child failed to re-orient the object under these circumstances before making his placement.

The final design consisted of total counterbalancing across the following variables:

1. sex of subject; 2. subject's grade in school; 3. order of presentation of the object-referent and self-referent conditions; 4. designation of the member of each pair to serve as the referent object for any particular trial; 5. for featured objects in the object-referent condition, order of face-orientations of the referent object. Within each placement condition, five of the most different possible orderings of the seven pairs of objects were systematically assigned across subjects. In addition, the six possible orderings of presentations of 'front', 'back', and 'beside' instructions were systematically assigned across each subject's trials for both kinds of placements. In these latter two instances, assignments of orders were made so as to approximate complete counterbalancing, true counterbalancing being impossible with the number of subjects tested.

Results and Discussion

The results are quite complex, for essentially, out of all the many different ways the children could-and did- make their placements, we saw our most important job to try to identify systems or patterns or

regularities. The categories that we have come up with, then, are nominal and post-hoc.

Object-referent condition

Featured objects. In referring to the featured objects, the meaning of "front", or "face side", is obvious in the case of dolls and bugs. Also, we will use the term to designate the headlight-side of the vehicles, and the open side of the chairs. In the object-referent condition with featured objects, all children but one set the placed object on the face side of the referent object for the "in front" instruction, on the back side for the "in back" instruction, and on either of the two remaining sides for the "beside"instruction. These placements occurred whether the face of the referent object was toward or away from or to one side of S. The one exception was a six and one half-year-old boy who consistently placed objects in the same location and facing the same way in reference to himself, essentially ignoring the changes in orientation of the face of the referent object. With this exception, these findings indicate that for these children, the face side of a featured object defines the front. That is, to place "in front" means to place on the face side, and whether the face side is toward or away from the child's own body is unimportant.

The placements of the featured objects can be considered not only with respect to where S set the placed object relative to the face of the referent object, but also how S oriented the face of the placed object relative to the face of the referent object. Here,too, there was near unanimity. The characteristic placement patterns are depicted in Fig. 1.

Fig. 1 about here

Shown are schematic representations of the subject, as seen from above. The open side of the circle indicates the subject's face side. Likewise, for the featured objects, the open side of the circle indicates the front or 'face' side. 'R' indicates the referent object, and F,B, and S indicate the locations of the front, back, and side placements, respectively. For featured objects, although all the drawings depict the referent object and subject facing in the same direction (i.e., the referent object is facing away from the subject), the same patterns appeared when the referent object faced to either side or toward the subject. Side placements occurred on either side; the drawings indicate the location of the more frequent placements.

In the object-referent condition with featured objects, the predominant pattern was one in which S matched the face orientation of the placed object to the face orientation of the referent object in all instances (Pattern Z). Of the total of 320 three-placement trials by the Ss, 275 (85.9%) were in this pattern. Table 1 illustrates the extremely high consistency with which the children followed this pattern. The table also shows that whether the object-referent placements came before or after the self-referent placements made no difference in the frequency of deviant patterns. Most of the 'deviant' patterns were Patterns X or Y, shown in Fig. 1. Twenty /trials in these patterns were accounted for by five children. The deviant patterns were more-or-less equally distributed across testing order, age, and sex.

Table 1 about here

The high uniformity of judgment across age and sex groups indicates that, despite the potential sources of ambiguity in this situation (e.g., conflicting cues from the front of the referent object, placed object, and the child's own body), nearly all the children agreed with one another that front is specified not only by the face side of the referent object but also by the orientation of the faces of both placed and referent object. These, then, are cues specified completely by characteristics of the objects and not by the child's own position in space. Or one might say that the children's placements were 'non-egocentric' in the Piagetian sense, with the single exception of the six and one/half year-old boy mentioned earlier.

Featureless objects. One of the major aims of this study was to determine the bases on which children would judge frontness and backness of objects actually lacking fronts and backs. Here the pertinent data are the placements of the featureless objects in the object-referent condition.

The major patterns of placement that appeared are shown in the bottom part of Fig. 1. Scores for the three pairs of featureless objects were combined because they were virtually identical. In one pattern (Pattern A), for the "in front" instruction, the child set the placed object on the near side of the referent object (i.e., between himself and the referent object). Consistent with this judgment, "in back" was on the far side of the referent object. This pattern suggests that the children were treating the side of the featureless referent object facing toward them as the front (i.e., the face or featured side) and the side facing away from them as the back or non-featured side.

The second pattern, Pattern B, was the reverse of Pattern A. Here S set the placed object on the far side of the referent object for the "in front" instruction, and on the near side for the "in back" instruction. This pattern suggests that the children were treating the far side of the referent object as the front and the near side as the back.

In both Patterns A and B, "beside" placements are depicted as occurring to the child's right. In fact, placements were made to both the left or right, but right-side placements were three and one/half times more frequent, a fact undoubtedly related to the higher incidence of right-handedness in our sample. The right side would be the more convenient side for the right-handed child insofar as a right-side placement would not require him to cross over the referent object.

A third pattern, Pattern C, located the front or back to the child's left or right (i.e., in what were the "beside" positions for Patterns A and B).

The number of trials on which these patterns of placement occurred is shown in Table 2. Pattern A was by far predominant. Considering the total

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Table 2 about here
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number of placements (N = 240), 160 (67%) were of this type, compared with 62 judgments (26%) for Pattern B. As for Pattern C, only 13 placements (5%) were made in this pattern. Regardless of the pattern used, in nearly all placements (97.5%), front and back were on opposite sides, and "beside" placements were on sides adjoining front and back. As was the case for featured objects, there were no differences between the older and younger children and between the boys and girls.

These being the three patterns used, the question arises, how consistent were individual children in the use of these patterns in each of the three three-placement trials with the featureless objects? As shown in Table 3, forty-five children used Pattern A with perfect consistency; 15 children used Patern B; and only one child used Pattern C consistently. Sixty-one

of the 80 children thus were perfectly consistent in their placements.

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Table 3 about here
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Again, then, Pattern A was by far predominant, and again, there was a very high degree of consistency of judgment of front and back for both the younger and the older children, and for both boys and girls.

Self-referent condition

In the self-referent condition for both featured and non-featured objects, the placements were completely uniform as respects front, back, and beside. That is, all the 80 children made their placements in the appropriate location in relation to their own bodies. This finding was hardly surprising inasmuch as it shows that the children merely knew the fronts and backs of their own bodies.

Variations in placements did occur in how S turned the featured objects on each of the three placements, i.e., in whether, when S placed an object, he oriented the object with its face side toward himself, away, or to one side.

We were able to distinguish three major types of patterns. These correspond to Patterns X,Y, and Z in Fig. 1, except that the child takes the place of the referent object. In Pattern X, the child placed the object so that its face side was toward himself in all three placements - in front, behind, and beside himself. In Pattern Y, S placed the object laterally so that its side faced him. In Pattern Z, S placed the object to face the same way that he faced.

The number of children using these three patterns is shown in Table 4. The frequencies are tabulated separately for each of the four types of featured objects, as well as according to order of testing.

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Table 4 about here
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Together, the three patterns accounted for about 75% of the total number of placements. Examination of the totals for Pattern X indicates that the children used this pattern primarily for the dolls and the chairs. But they did not do this with the bugs and vehicles. Instead they employed Pattern Y, i.e., with the sides of the objects facing the child. We wonder whether the reason for this difference may lie in the manner in which these different types of objects are ordinarily held in play. The bugs and vehicles are objects which a child would grasp by the sides and then would push laterally. Probably, the child pushes the object in this manner because this is the most comfortable posture for playing with small, wheeled toys. The dolls and chairs, on the other hand, are less likely to be played with consistently in this way. Instead, they would seem to be objects which children often play with in a face - to-face manner.

We therefore might expect that the way in which <u>any</u> object is used would influence its orientation in a front-back placement. Even an adult, asked to place a cup or book "in front" of himself, might be quite unlikely to place the cup with the handle facing him, or the book with the spine facing him.

This main effect of kind of object, however, interacted with order of presentation of referent conditions. The difference was strongest when

the self-referent condition came first. When the object-referent condition came first, the effect was attenuated and the third pattern, Pattern Z, came in. Recall that Pattern Z was the typical pattern observed for the object-referent placements. The children, it seems, had generalized a set from the preceding object-referent condition so that now, on the self-referent trials, they placed the object to face in the same direction as their own bodies. One might say that when the self-referent condition followed the object-referent condition, the child was more likely to treat himself as another object in relation to the object which he was asked to place, rather than to treat himself as a <u>user</u> of the object.

We should note that this interpretation of the order effect is possible (we might say that <u>any</u> interpretation is possible) only because the children's placements of the featured objects in the object-referent condition were so highly consistent within themselves and across subjects. In other words, there would not appear to be much danger of higher-order interactions between <u>type</u> of placement of featured objects in the object-referent condition and pattern dominance in the self-referent condition when it followed the object-referent condition.

At this point we can discuss an aspect of our findings which appears in Table 2 and which we previously did not mention. As we pointed out earlier, on the object-referent trials with featureless objects, there were no differences in the incidence of use of Patterns A and B by sex or age. There did seem to be a difference, however, according to order of testing. When the object-referent trials preceded the self-referent trials, Pattern A occurred about half again as often as did Pattern B, whereas when the object-referent trials followed the self-referent trials, Pattern A occurred more than four times as often as Pattern B. We have just pointed

out that on self-referent trials, when they precede object-referent trials, children are most likely to place the dolls and chairs facing themselves (Table 4, Pattern X). We suggest that this prior experience with certain featured objects carries over to the object-referent trials with featureless objects so that a child, asked to place one featureless object in front of another, behaves as though he has imposed the face-orientation of the preceding featured object onto the featureless object. That is, he now sees the featureless object as 'facing' him so that his front placement of a second object is on the near side. If this interpretation is valid, we can see that the effect of testing conditions goes both ways: not only do prior object-referent trials influence self-referent trials, but prior self-referent trials also influence object-referent trials. We are, of course, discussiong what are only trends in the data, any definitive interpretation of which must rest on further studies.

Conclusions

Despite the potential sources of conflict between types of cues, some of which were mentioned earlier, the results show that the children agreed both with themselves and with each other as to what defined fronts and backs of objects. This consensus was particularly evident in the object-referent condition where over 80% of placements of featured objects and 67% of placements of featureless objects were made in the same way by all children.

There were, to be sure, individual differences in children's placements. Even here, however, there is evidence of consistency. Where placement patterns did not follow the standard form, most frequently there was some simple variation of the standard pattern -- for instance,

rather than placing the object to face the same direction as the referent object on all three placements, the child would place the object facing the referent object for the "in front" instruction but facing the same way as the referent object for the other two instructions. Further, children who did deviate from the standard pattern typically showed only one or two such variations; and the five children who never used the "standard" pattern nonetheless were highly consistent in using a single variant, or at most two variants, across all 12 object referent trials.

This high degree of regularity in situations containing numerous bases for irregularity leads us to wonder whether development of the spatial system of front-back may be an analogue of grammatical development in children. Research has shown that children are over-regular in their use of grammatical forms. For instance, Jean Berko (1958) showed children a picture of a man swinging something about his head, and said, "This is a man who knows how to gling. He glings every day. Today he glings, yeaterday he _____." Preschool and early elementary school children promptly respond, "yesterday he glinged." But adults hang suspended between gling, glang, and glung, and even glaught. Presumably their greater sophistication with irregular forms led to the greater variability in their responses.

We are not suggesting that the development of spatial judgments follows as complicated a course as does the development of grammar. But if the analogy between them is at all valid, we would expect that children would learn first to respond to the most frequent and regularly recurring cues for front and back, and that only with increasing age (and its concomitant increasing sophistication with cue possibilities) would

embroideries upon this basic regularity appear. One then might expect adults' placements in a task like this to show wider variability, or at least greater sensitivity to the potential conflict between different cues, than do children's placements.

We also see several other directions for further research. First would be closer study of body cues in front-back judgments of animal figures. Does the face always define the front of the body, or does it define front only when it is aligned in the same direction as the body? We recently have completed a study of how children place one doll "in front of", "in back of", and "beside" another doll whose head is turned to the side (Harris & Strommen, 1971).

Still another direction for research would be an attempt to specify precisely those cues which define the front-back sides and which distinguish them from the sides we call the "sides". We are trying to answer this question by eliciting judgments of front and back for specially-designed geometric figures.

We think that what we have found so far substantiates our view that reliance on any single test of front-back (which is based upon the child's own body) is likely to yield a misleading picture of the quality of the child's knowledge of front-back. We conclude that the concept of front-back is more complex and subtle than has been hitherto believed.

References

Berko, J. The child's learning of English morphology. Word, 1958, 14, 150-177.

Harris, L. and Strommen, Ellen A. The role of face and body cues in children's judgments of front, back, and side. Paper presented at Biennial Meeting of the Society for Research in Child Development, Minneapolis, Minnesota, 4 April, 1971.

Footnotes

1. Portions of the research were reported at the meetings of the Midwestern Psychological Association, Cincinnati, Ohio, 30 April 1970. We are grateful to the principal, staff, and children of the Red Cedar Elementary School and Spartan Village Elementary School, East Lansing, Michigan, for their cooperation. We also thank Suzanne Marshall for assistance in the development of the study.
2. Request for reprints should be sent to Lauren Harris, Department of Psychology, Michigan State University, East Lansing, Michigan 48823.
3. Prizes proved useful with children of this age as a means of maintaining incentive. Because we did not wish to signal to the child that there were right or wrong answers to our questions E placed Ss chosen prize in a bag, wrote the child's name on the bag, and gave the bag to the child to hold before testing was begun.

Table 1. Object-referent Condition with Featured Objects: Consistency with which Children Matched Face-orientation of the Referent Object (Pattern Z) on All Placements over 12 Trials (Each trial = three placements)

Order of Testing –	Following Self-referent Trials	Preceding Self-referent Trials
Number of Trials on which S was consistent	Number of Ss	Number of Ss
0	3	2
5	0	2
6	0	1
7	1	0
8	0	2
9	3	2
10	3	3
11	11	5
12	19	23

Table 2: Object-Referent Condition with Featureless Objects: Number of Trials on which Characteristic Placement Patterns Occurred According to Sex of Child and Order of Testing. (Each trial = three placements)

Placement Pattern	Following Self-referent Trials		Preceding Self-Referent Trials		Total
	Girls	Boys	Girls	Boys	
A	47	47	31	35	160
B	12	9	22	19	62
C	1	3	7	2	13
Other	0	1	0	4	5

Table 3. Object-Referent Condition With Featureless Objects: Number of Children Showing the Same Placement Pattern on All Three Object-Referent Trials According to Sex of Child and Order of Testing. (Each Trial = Three Placements)

Placement Pattern	Following Self-Referent Trials		Preceding Self-Referent Trials		Total
	Girls	Boys	Girls	Boys	
A	15	13	7	10	45
B	4	2	5	4	15
C	0	0	1	0	1
Other	0	0	0	0	0

Table 4. Self-Referent Condition with Featured Objects: Number of Children Showing the Various Placement Patterns According to Type of Toy and Order of Testing

	Preceding Object-Referent Trials N = 40				Following Object-Referent Trials N = 40				Combined Testing Orders N = 80			
Placement Patterns	Dolls	Bugs	Vehicles	Chairs	Dolls	Bugs	Vehicles	Chairs	Dolls	Bugs	Vehicles	Chairs
X	31	2	1	22	17	9	9	16	48	11	10	38
Y	0	21	27	6	0	3	5	0	0	24	32	6
Z	0	0	1	2	18	15	12	15	18	15	13	17
Other	9	17	11	10	5	13	14	9	14	30	25	19

Figure 1. Object-referent-condition:
Characteristic placement patterns for
featured and featureless objects*

*Shown are schematic representations of the subject, as seen from above. The open side of the circle indicates the subject's face side. Likewise, for featured objects, the open side of the circle indicates the front or 'face' side. 'R' indicates the referent object. F, B, and S indicate the locations of front, back, and side placements, respectively.

The same patterns appeared in the self-referent condition; simply substitute 'subject' (in same face-orientation as shown) for 'referent object'.

Figure 1. Object-Referent-Condition: Characteristic Placement Patterns for Featured and Featureless Objects.